APPENDIX II

TAB G

REBUTTAL TO WITNESSES FOR THE PLAINTIFFS
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Case: *Tammy Kitzmiller, et al. v. Dover Area School District and Dover Area School District Board of Directors*

Case No. 04-CV-2688

In response to assertions made by Drs. Alters and Padian, the Dover School District policy meets several legitimate pedagogical goals. The following discussion illustrates how and why using standards from the science education community.

To begin, Alters and Padian assert that the Dover policy results in poor pedagogy and improper and inferior science education because it:

a. makes students aware both of gaps or weaknesses in evolutionary theory and of other alternatives,
b. requires teachers to disregard and contradict the science community by teaching that intelligent design theory (IDT) is science and that there is no debate in the science community about the nature of evolution, and
c. undermines the "structure and logic of science."

However, the legitimacy of the policy is evident in at least four ways. First, it accurately makes students aware of evolution as a developing theory rather than a proven fact. Second, it raises student awareness to the existence of alternatives currently discussed and debated both within and outside of the scientific community. Third, it encourages students to think critically, which is an important skill both in science inquiry and general learning. Finally, it accomplishes all of this while maintaining a standards-based focus on evolution.

1. *Evolution as Theory Rather than Fact*

Although Dr. Alters would have students believe evolution is an unquestioned cornerstone of science, those in the science community indicate otherwise. In their expert reports, Drs. Dembski, Minnich, and Behe effectively presented numerous examples of those in the scientific community who question various aspects of the utility, validity, and accuracy of evolution. Moreover, the Dover High School course text states, "Like any scientific theory, evolutionary theory continues to change as new data are gathered and new ways of thinking arise…[R]esearchers still debate such important questions as precisely how new species arise and why species become extinct. There is also uncertainty about how life began" (p. 386).

Even the *National Science Education Standards* (*NSES*), created and endorsed by the National Science Teachers Association, the National Science Foundation, the National Academy of Sciences, and the National Research Council, among others, characterize evolution as "incomplete."

> Because all scientific ideas depend on experimental and observational confirmation, all scientific knowledge is, in principle, subject to change as new evidence becomes available. The core ideas of science such as the conservation of energy or the laws of motion have been subjected to a wide variety of confirmations and are therefore unlikely to change in the areas in which they have been tested. In areas where data or understanding are incomplete, such as the details of human evolution or questions surrounding global warming, new data may well lead to changes in current ideas or resolve current conflicts. In situations where information is still fragmentary, it is normal for scientific ideas to be incomplete, but this is also where the opportunity for making advances may be greatest. (National Science Education Standards, 1996c)

Therefore, the Dover policy accurately and legitimately represents the current status of the understanding of evolution as illustrated by discussions within the scientific community, the course text, and the *NSES*.

2. *Discussion and Debate about Alternative Theories*

Contrary to the assertions of Alters and others, there is current discussion and debate both within and outside the scientific community about alternatives to evolution, one of which includes IDT. In their export reports, Drs. Behe and Campbell provide ample evidence to this fact. Further, in an article on the testability of evolutionary hypotheses, Penny, Hendy, and Poole (2003) include IDT as a legitimate alternative scientific theory.

Outside the scientific community, the debate's latest manifestation comes in the form of hearings by the Kansas State Board of Education on IDT and evolution (Hanna, 2005). This follows similar discussions in Ohio (Parker, 2004) and action in the United States Senate calling for the teaching of such debates, including their origins and the views represented therein (United States Senate, 2001).

The pedagogical result of making students aware of these discussions and debates is consistent with the *NSES* in at least two ways. First, it prepares students for their role in public dialogue. "The goals for school science that underlie the *National Science Education Standards* are to educate students who are able to…engage intelligently in public discourse and debate about matters of scientific and technological concern" (National Science Education Standards, 1996d).

Second, it demonstrates the role of new ideas and theories in science and the importance of intellectual diversity.

> Science is a discipline in which creative and sometimes risky thought is important. New ideas and theories often are the result of creative leaps. For students to understand this aspect of science and be willing to express creative ideas, all of the members of the learning community must support and respect a diversity of experience, ideas, thought, and expression. (National Science Education Standards, 1996b)

Of course, one may argue, as do Alters, Padian, and others, that IDT is not science, thereby negating its standing as a legitimate alternative. Again, the expert reports of Drs. Dembski,

Minnich, and Behe demonstrate the scientific nature of IDT. Intelligent Design research has been published in peer-reviewed, scientific journals. IDT researchers have a clear scientific research agenda, and IDT principles inform the work of research scientists.

Undoubtedly, IDT represents a minority viewpoint in the science community, and using the aforementioned language from the *NSES*, one could describe IDT as "new," "creative," or "risky." However, that does not contradict its standing as a legitimate alternative nor provide reasonable motivation to prohibit school personnel from merely making students aware of its existence by referring them to a book in the school library. Indeed, the Dover policy seeks to create a "learning community [that] support[s] and respect[s] a diversity of experience, ideas, thought, and expression" consistent with the *NSES*.

3. *Critical Thinking in Scientific Inquiry*

According to the *NSES* (1996c), critical thinking plays a central role in scientific inquiry, and students should learn those skills in an active, engaged manner.

> Student inquiry in the science classroom encompasses a range of activities. Some activities provide a basis for observation, data collection, reflection, and analysis of firsthand events and phenomena. Other activities encourage the critical analysis of secondary sources—including media, books, and journals in a library. (National Science Education Standards, 1996b)

The Dover policy adheres to this description. Students are encouraged to think critically about what they read and hear in class and also to analyze alternatives through a secondary source in the school library.

The latter activity is specifically discussed in the national standards.

> RECOGNIZE AND ANALYZE ALTERNATIVE EXPLANATIONS AND MODELS. This aspect of the standard emphasizes the critical abilities of analyzing an argument by reviewing current scientific understanding, weighing the evidence, and examining the logic so as to decide which explanations and models are best. In other words, although there may be several plausible explanations, they do not all have equal weight. Students should be able to use scientific criteria to find the preferred explanations. (National Science Education Standards, 1996c)

Applied specifically to the case in question, as a result of the statement read in class Dover students may read *Of Pandas and People* in the school library and dismiss IDT as the weaker argument. They may, instead, conclude that evolution is the preferred explanation. If IDT is as sloppy as critics contend, and if evolution is as ironclad as they portray, a critical analysis of the alternative will only strengthen the case for evolution, thus allaying Alters' fear of sending "an inaccurate signal that evolution is an inferior science."

Moreover, if students are presented a singular position about evolution (inferring that it is unquestionable) and are never made aware of alternatives, students lack the opportunity to

practice this skill of "recogniz[ing] and analyz[ing] alternative explanations and models" as it relates to evolution, a skill scientists not only recommend but practice.

For example, Sober and Steel (2002) assert that the "Hypothesis of Common Ancestry," a central feature of contemporary evolutionary theory, "needs to be looked at more closely" (p. 401). They continue:

> This proposition is central because it is presupposed so widely in evolutionary research. When biologists attempt to reconstruct the phylogenetic relationships that link a set of species, they usually assume that the taxa under study are genealogically related. Whether one uses cladistic parsimony, distance measures, or maximum likelihood methods, the typical question is which tree is the best one, not whether there is a tree in the first place. The same presupposition is at work in the pattern of reasoning that biologists often use to develop adaptive hypotheses. When biologists consider the possible adaptive reasons why a species exhibits some trait, they usually think about the trait as evolving against a background of biological features already in place. They infer what that ancestral condition was by assuming that there is a phylogenetic tree that unites the species of interest with other species. Traits of sister groups are then "read back" into the past (using parsimony or some other method of inference), thereby providing an estimate of the trait values of ancestors. In view of the importance within evolutionary biology of the Hypothesis of Common Ancestry, it is worth reviewing what evidence there is that the hypothesis is true. (p. 395-396)

Sober and Steel then examine various models to test the "Hypothesis of Common Ancestry," concluding it is intrinsically difficult to test. Penny, et al. (2003) respond to Sober and Steel by suggesting ways to test not only the descent hypothesis but also alternatives, including intelligent design.

These two articles illustrate several points of note. First, as referenced earlier, sufficient questions about evolution persist so that scientists continue to examine and debate its various components. Second, intelligent design is examined as a scientific alternative. Third, scientists critically investigate evolutionary tenets and recommend others do likewise.

Indeed, the *NSES* (1996a) state: "Inquiry requires identification of assumptions, use of critical and logical thinking, and consideration of alternative explanations." As such, the Dover policy aligns effectively and legitimately.

4. *A Standards-Based Focus on Evolution*

Whether implicitly or explicitly, the *teaching* of IDT plays a central role in the arguments of Alters and Padian. Indeed, the latter states, "If [IDT] were presented in science classes," it would result in an understanding of evolutionary biology that would be "deficient and misinformed" and science training that would be "significantly inferior." The prior discussion and the reports and rebuttals of other witnesses for the defense clearly debate the latter portion of Padian's argument, but in many ways the arguments place second in priority to the operative word in Padian's statement—If.

In fact, Dover High School biology courses do not teach IDT. They teach only evolution consistent with the Pennsylvania State Academic Standards for Science and Technology (Pennsylvania State Board of Education, 2002) and the *NSES* (National Science Education Standards, 1996c). Moreover, the course text and presumably other direct course materials do not teach IDT. Students are encouraged to analyze other alternatives, of which IDT is one, *on their own initiative and time.*

Thus, by encouraging critical thinking, facilitating the analysis of alternative ways of knowing, and making students aware of current discussions, trends, and debates both within and outside the scientific community related to evolution, the Dover schools strive toward legitimate pedagogical goals while maintaining a standards-based curriculum focused on evolution.

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Signed: _____ **Date:** May 16, 2005